

MANAGEMENT OF MAJOR CANAL SYSTEMS IN BIHAR

(A KOSI CASE)

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Introduction

There is a growing interest in recent years in the performance of major irrigation systems in South and South East Asia. This interest stems out on account of huge investment made in these schemes. However, one disturbing feature of these big projects all over Asia has been their unsatisfactory performance on agricultural front. Invariably the poor performance has been explained in terms of technical deficiencies in planning, design or operation. As a result, the solutions which are sought also relate to removal of these physical deficiencies. But recently, in certain quarters, emphasis has been laid on the role of management factors in the performance of these systems. This paper deals with some aspects of management of one major canal system in Bihar. The paper is divided in four sections. We begin with Kosi region and irrigation system in section one. The second section deals with the problems of small and marginal farmers. Water utilization and agricultural benefits have been discussed in section three. Finally, we have highlighted some specific problems of Kosi irrigation management and suggested the remedial measures.

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1. Kosi Region and Irrigation System

Kosi is one of the major canal systems in Bihar (the other being Sone and Gandak). The project was primarily intended as a flood protection device but it was considered desirable to construct flow irrigation canals to irrigate large area on the eastern side of the river. The 2.37 million acres GCA (with a CCA of 1.58 million acres)¹ estimated in the project report spreads over the districts of Saharsa, Purnea and Katihar in the north eastern part of Bihar. Fifty eight per cent of the geographical area of these districts fall within the GCA of the Kosi project. The combined area of the three districts is about 17 thousand kilometers with a population of about 6.3 million (1971 Census). Thus the density of population comes to 372 per square kilometer as against Bihar's 324. The total working population in the three districts is 2.14 million, of which .9 million are cultivators and .97 million agricultural labour. The percentage of workers in agricultural sector to total workers in the area is about 88 (Bihar 80%, India 69%). Only 2.6 per cent of total workers are engaged in the industry (5.1% in case of Bihar). The percentage of literacy is about 15.6 (19.9% in case of Bihar) and the rural population constitute about 94 per cent (Bihar 90%, India 80%).

The components of the original project report (1953) were,

- (i) a barrage across the river at Hanumannagar in Nepal;
- (ii) flood embankments on both sides of the river and pro-

tective measures; (iii) eastern Kosi Canal System, designed to provide annual irrigation to about 1.4 million acres in Saharsa and Purnea districts; and (iv) Chatra Canal System in Nepal. During the Third Five Year Plan (1961-66) the new schemes incorporated in the project were; (i) hydel power station on the main canal to generate 20,000 KW; (ii) the Rajpur branch canal taking off from the eastern main canal, intended to irrigate an area of about 0.4 million acres in Saharsa; (iii) the Western Kosi Canal System with the western main canal taking off from the barrage, intended to irrigate an area of 0.8 million acres in the district of Darbhanga and Nepal; (iv) extension of the two eastern and western flood embankments; and (v) construction of water courses upto one cusec capacity.

Evolution of Organization

To start work on Kosi project, a separate government department named as Kosi Project Department, was established in 1954. It was headed by a person of IAS cadre, designated as Chief Administrator-cum-Principal Secretary of the department. In September 1954 the State Government constituted the Control Board and it was placed in over all charge of the project including its technical and financial aspect. The Governor and Chief Minister of Bihar were the Chairman and Deputy Chairman respectively of the Board. The members of the Board included Secretary, Ministry of Finance, Government of India, Chairman, Central Water and Power Commission and two

members of Planning Commission. From the side of the State Government were, Finance Minister, Chief Administrator of the project, Chief Accounts Officer of the project, Chief Engineer of the project and Secretary of Planning among others.

Irrigation from Kosi Canal System started in 1964 and in 1966 the IAAP² (Intensive Agricultural Area Programme) was introduced in 21 out of 59 blocks in the Kosi area when it was thought that it had qualified by becoming an area of assured irrigation. The IAAP, which aimed to have a 'package' of inputs adopted by farmers in effect implied additional staff, facilities and duties - specifically directed towards agricultural innovations - on the existing organizational structure of the block. To coordinate the programme for the whole region, the post of Kosi Area Development Commissioner (KADC) was created. He was notified as Additional Commissioner of the two districts of Kosi Command Area and started functioning from November 1965. The arrangement continued till the end of September 1972 and with the creation of a new Kosi Division the functions of KADC, which were mainly concerned with the agricultural development in the region, were merged with the many other responsibilities of the Divisional Commissioner.

Another development which is important from the point of view of Kosi irrigation project was the establishment of Kosi Area Development Authority by the Government of Bihar

in October 1973, and later its conversion into Kosi Command Area Development Agency (CADA) in December 1974. The jurisdiction of the Agency is not confined to the command area of the Kosi Canal System but it covers all the three districts in Kosi Division. It is responsible to initiate, integrate and implement all development activities connected with agriculture and water utilization in these districts. The Agency is expected to coordinate the work of various departments, like Irrigation, Agriculture, Soil Conservation etc. and functions under the Chairmanship of Kosi CADA Commissioner. Besides others, the Irrigation Commissioner, the Director of Agriculture and the Chief Engineer Kosi Project are its members.

Kosi project continues to be a part of Irrigation and Power Department. The department is headed by the Ministry of Irrigation who is a politician. He has overall authority for all areas encompassed by the department and is directly responsible to the cabinet of which he is a member, and to the State Legislature. The next position in the hierarchy is occupied by the Irrigation Commissioner who is the principal secretary of the department. He is a generalist administrator (IAS) and heads what is usually referred to as the policy wing of the Ministry. Next in line is the Secretary who is also an IAS. Below him are two Special Secretaries, one an IAS, the other an engineer designated as Engineer-in-Chief-cum-Special Secretary. He is a techno-

crat in the charge of overseeing the technical and implementation aspects of various irrigation projects in the state, and the Kosi project is one of them.

At the project level, the Chief Engineer Kosi (Eastern) is overall incharge of the project. He has eight Circles under him and each Circle is headed by a Superintending Engineer. The various units of administration below Circle are Divisions, Sub-divisions and Sections. These units are headed by Executive Engineers, Assistant Engineers and Overseers respectively. Generally each Circle has four Divisions, each Division four Sub-divisions and each Sub-division four sections. However, the number of administrative units at each level is determined on the basis of the amount of work to be done and funds available for that work.

2. Small and Marginal Farmers

Coming to the major concern of the present workshop regarding intervention directed towards the rural weak and poor, the first question we ask overselves is, whether there is an inequitable distribution of water among the different categories of farmers or not. There is every likelihood of an inequitable distribution of water if the plots of big farmers are located near the head reaches and those of the small farmers at the tail-ends because in the absence of any effective control mechanism, there is an abundance of water in the head reaches and a scarcity in the tail-end reaches

of the canal. In Bhakra Reidinger noticed that the holdings of the larger and more powerful land holders often were close to the head of the water course.³ However, there is no such empirical evidence available to us in case of Bihar. On the contrary, Pandey on the basis of a socio-economic survey of Kiul, Badua, Chandan Command Area in Bhagalpur and Monghyr districts (Bihar) concludes that canal as a source of irrigation is relatively equitable in providing benefits to various categories of land holders.⁴

In case of Kosi region we do not have any recent data, however, the Agricultural Census, 1971 (see table 1) does not suggest any kind of bias against small farmers (having land upto 2 hectares). Two things emerge very vividly from the data. First, canal is the most important source of irrigation in Kosi area and of the total irrigated area, 81.55 per cent is irrigated by canal and only 18.45 per cent is by the rest of the irrigation sources. Second, the biggest beneficiaries of canal irrigation are the farmers with the holdings of 5 to 20 hectares. Farmers with land holdings over 20 hectares are not using irrigation to the extent of other categories of farmers. It may be on account of the fear that if they irrigate more land, the record may be used as an evidence in the event of implementation of land holding ceiling Act.

However, it would be wrong to be guided only by the data in Table 1, because it does not fully reveal the problems

associated with the small farmers in Kosi area. In addition, the data may not hold good today. Clay has demonstrated that there has been a spurt in the number of bamboo tubewells from 1,438 in 1970-71 to 55,591 in 1977-78.⁵ The impact is clearly visible in the data presented by Singh for 'rabi' season in 1976-77. According to his data, private tubewell is the most important source, irrigating 58.2 per cent of the total irrigated area followed by canal (26.1 per cent) other sources (13.8 per cent) and state tubewells (1.99 per cent).⁶

In Kosi area the problems of small farmers are much more acute because of an extremely uneven distribution of land holdings and large concentration of population in the smaller holdings. The Agricultural Census, 1971 indicates (see Table 2) that the holding size upto 2 hectares (less than 5 acres) constitute 76.49 per cent of the holdings, while it contains only 27.04 per cent of area. On the contrary the size of 5 to 20 hectares constitute only 6.30 per cent of holdings but it covers 31.07 per cent of area.

The condition of small farmers in Kosi region is going to be worse on account of the pressure of the population on land. The region has experienced very high population rates during the last two decades. During 1951-61 and 1961-71 there is an increase of 31.75 per cent and 24.50 per cent respectively in Saharsa and an increase of 37.02 per cent and 27.60 per cent respectively in Purnea.⁷ This means swelling in the number of smaller holdings and a fall out in

the numbers of large holdings. The number of people to be supported by holdings in each size category is bound to increase, even without partitioning.

The problems of the small farmers have not escaped the attention of various researchers who have studied Kosi region. Many of them view that the tenurial conditions prevailing in that region are responsible for the worsening plight of small farmers. Chakravarty,⁸ who studied the problems of small farmers in Kosi area has documented following factors as handicaps of the small farmers; fragmentation of holdings, insecurity of tenure, inadequate and untimely supply of inputs, inadequate and untimely irrigation, unsuitability of land, lack of credit facilities and other factors like storage, marketing etc. Chakravarty views insecurity of tenure as the most important handicap suffered by the share croppers. According to Ladejinsky, "The crux of the matter is that in Bihar such essentials as security of tenure, regulation of rents and ceilings of land ownership are in the deepest doldrums, perpetuating a land structure as inequitous as it is inefficient".⁹ He further points out that, "the entire array of legislative measures suffers from acts of Commission and omission, the sum of which is that in the vast majority of cases and goals are yet to be realized".¹⁰

Varghese's 'Kosi Kranti' (Kosi revolution) programme started

in the five blocks of Purnea aimed at effective and speedy implementation of land reform measures by combining the power of the people with that of the state was based in the premise that the tenurial conditions existing in the Kosi area were responsible for the backwardness of the region. Therefore, the programme emphasized on immediate and effective implementation of agrarian reform laws and security of written land rights for cultivators to be followed by supplying developmental inputs to smaller and unresourced farmers.¹¹

In the Kosi region, the Small Farmers Development Agency (SFDA) is a major state interventionist strategy directed towards the poor farmers. It is based on the assumption that a farmer with 3 or 3.5 acres is viable if he has an assured water supply and the necessary inputs to go with it.

In reality most of the small farmers lack the other inputs even when they have water. SFDA scheme was initiated in 1969, aimed at enabling potentially viable farmers to participate in development and share in the benefits. In 1969-70 the scheme covered 3 blocks and now covers 24 block of Purnea district.

The scheme provides special credit, advisory and other services to cultivators who own and cultivate between 2.5 and 5 acres. The object is to make this category of peasant economically viable by providing, on favourable terms (reduced rates) necessary resources which would be denied to him through the market. However, Guru in a recent evaluation¹²

of the agency found that the role of cooperatives and commercial banks in providing finances to small and marginal farmers has not been up to the expectations. His sample survey of 12 villages indicated that the number of identified small and marginal farmers was less than their actual number. In the survey villages, 83.91 per cent of the actual number of the small and marginal farmers were identified by SFDA. The survey also suggested that there was no enthusiasm on the part of farmers to become members of the cooperative societies. The poor membership of the societies was a very important cause of lower level of beneficiaries of the various schemes of development supposed to percolate to the small and marginal farmers.

Rodgers and Wood, who conducted their field work in the Kosi area nearly a decade back were also critical of the role of the cooperative societies. Rodgers was of the view that at village level cooperatives were run by village elite for their own purposes.¹³ Wood in his village study, which was a SFDA area, found that with two exceptions, all the members of the cooperative society had more than 5 acres of land and membership among the small farmers (2.5 to 5 acres) was about 22 per cent.¹⁴

3. Water Utilization and Agricultural Benefits

The figures available to us (see Table 3) indicate that the utilization of the potential was poor upto 1975-76. The average irrigation during the five years 1971-72 to

1975-76 was 18.2 per cent of the area planned to be irrigated as per the project report.¹⁵ The highest utilization achieved in any year was 25.3 per cent in 1972-73, which was a year of drought. That year the discharge of water was very high and the average during kharif season was 12,000 cusecs and the maximum was 14,543, while the average discharge for eight years (1967 to 1974) during the kharif was about 8,000 cusecs and the maximum was 10,700.

Coming to the achievements regarding the intensity of cropping and increase in production resulting from canal irrigation, no separate figures of production for the Kosi Command area are compiled by the Government. As a result we have to depend on district-wise figures. From the figures (see Table 4) supplied by the Department of Agriculture, there is little evidence of any increase in the intensity of cropping after the introduction of irrigation. The average intensity of cropping for the three years 1963-64 to 1965-66 was 1.35 which was marginally more than the average intensity of 1.34 for the year 1971-72 to 1973-74.

Productivity of crops (see Table 5) worked out on the basis of figures of crop-wise area supplied by the Directorate of Statistics and Evaluation reveal that, while the record of wheat yields have shown a steady improvement, the paddy yield are most uneven. The yields of 1.79 quintal per acre of kharif paddy during 1971-72, which was a high rainfall year against the yield of 3.39 quintal per acre during 1972-73,

which was a drought year can be explained only in terms of a high discharge of water during that year. The anticipated per acre yields assessed in the project report were 4.85 quintal for kharif paddy and 4.10 quintal for wheat. While in case of wheat this has been achieved during the last three years (1971-72 to 1973-74), it is nowhere near anticipated achievement in case of kharif paddy. It should be noted that the findings of a recent study of Programme Evaluation Organization of the Planning Commission, concerning the benefits of the Kosi Embankment are not very heartening in the agricultural front. It finds no appreciable change in the development of agriculture even after two decades of construction of the embankment.¹⁶

The questions that arise are related to lower discharge of the canal than designed, low utilization of irrigation potential, low productivity and low crop intensity. Siltation is said to be the main cause of lower discharge of the main canal and canal sections. As a consequence of heavy siltation, the present water carrying capacity of the canal sections is said to be reduced considerably and the discharge capacity of the main canal is limited to only 10,000 cusecs which is two-third of the designed discharge. Some long terms measures like, construction of a control structure down stream of Bhimnagar barrage at Dagmara in Nepal, have been suggested and short term measures like, installation of a silt ejector at Bhimnagar barrage and closure of the canal during summer for the disiltation operations have been adopted.¹⁷ The

poor performance in the agricultural front is explained in terms of closure of the canal during summer¹⁸ and low utilization of available water.

The unsatisfactory performance of Kosi project is generally explained by the engineers on account of the technical deficiencies in the irrigation system. Various committees which were appointed from time to time have given negligible attention to the management component. Even the CAD programme initiated by the Central Government has put too much emphasis on the technical diagnosis of the problem, suggesting construction of field channels and drains, lining of canals, fixing of regulators, levelling of land etc. As a consequence of high importance which is being attached to completion of physical links, high targets are being fixed for the construction of field channels and other on-farm development activities.¹⁹ This has led the state governments to lay total emphasis on construction works covering land development, field channels and drains, overshadowing the other objective of coordination for which the authority was created. It is not our purpose to highlight the numerous technical deficiencies which are often mentioned and enumerated in various committee reports but to highlight some of the problems associated with the management of Kosi irrigation systems and suggest remedial measures in the next section.

4. Some Problems and Remedial Measures

Kosi CADA

In May 1973, Union Agriculture Minister in a letter to the Chief Ministers of the States showed his concern for the poor performance of major irrigation systems. Subsequently, there were series of discussions between the representatives of the State Governments and a Central Team and there was general agreement on adoption of an area development programme instead of taking up various programmes in isolation and hence need of a unified organization with a direct line of command. State Governments were requested to set up CAD authorities for 51 irrigation projects which were identified in consultation with the State representatives. As a consequence of the directives of the Government of India in September 1973, four CADA authorities, namely, Kosi, Gandak, Sone and Kiul Badua Chandan, were set up in Bihar.

The ineffectiveness of the Kosi CADA is the first and foremost problem. The agency was created with the objective of better utilization of water resources through integrated area development. Since the agency was to coordinate the activities of various departments, the Chairman of the Agency was to have "direct control over the staff and programmes of agriculture, irrigation, cooperation, soil conservation, etc." The ordinance (later converted into an Act) by which this Agency was created lists a number of specific responsibilities to be shouldered by the Agency. However, the Agency has

not been given any administrative or financial powers in relation to functions of other development departments. Agency's Chairman's power of a head of the department to approve the tour dairy, counter sign travel claims and to write the character rolls of officers of these departments exists only on paper. As a result, the Agency has no real authority to fix and enforce a cropping pattern, to regulate the release of irrigation water accordingly and to redistribute funds under various programmes to secure optimum results. The creation of authority can only be justified if it brings about co-ordination in the functioning of different departments. However, it can not be obtained unless adequate powers are genuinely transferred to CAD authorities which is not evidenced in the working of Kosi CAD.

What is needed is the establishment of a separate CADA department at the State level and appointment of an Additional Commissioner for Kosi command area. He should be made ex-officio Chairman of the CADA Agency and may be designated as Development Commissioner. All the officials working in the command area should be placed under the dual control of Commissioner and Development Commissioner. He should be responsible for all the agricultural development in that division and the officials working in the command, including Chief Engineer, Kosi, should take instructions from him for the works related to agriculture and irrigation. In the present arrangement the Commissioner is so much over-burdened

with his numerous responsibilities concerning civil administration that he can not pay much attention to agricultural development.

Water Logging

The present day water logging problem is a consequence of bad water management. Dangers of water logging were sounded in the Kosi project report itself and adequate drainage suggested. The Kosi Technical Committee (1971) noted that the subsoil water had gone up by 2 to 3 feet between 1965 and 1970. Despite the magnitude of the problem, no serious step was taken till 1971-72 when a Drainage and Investigation Circle with four divisions was created. The Circle in 1975 assessed that an area of about 0.3 million acres in the command was suffering from surface accumulation of water. The menace of water logging would not have attended the present proportions, if attention would have been given to drainage along with irrigation. Drainage was essential and should have been undertaken along with the construction of the Canal system. However, the same mistake should not be repeated by doing the work of drainage in isolation and without land levelling. The drainage can become an effective aid to cultivation only if the land is properly levelled.

Surface drainage is only one way of tackling the problem of water logging. The other is greater and co-ordinated use of subsoil water for irrigation purposes. Earlier we have pointed out that there has been noticeable rise in water

table after the introduction of canal irrigation and in some of the area it is very close to surface. Therefore, the best course would be to stop canal irrigation in such critical areas in all seasons by providing water through shallow tubewells or bamboo borings. This will protect such areas from being water logged by maintaining water table depth within the safe limit.

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Water Rates

The management of water rates is similarly marred by mal-administration, inefficient procedures of assessment and collection and corruption. It may be seen from the data available to us (see Table 6) that out of the total demand for Rs.51.64 million during the six years, from 1972-73 to 1977-78 (upto February) a sum of Rs.21.89 million was actually realised. This comes to 42.39 per cent of the total demand. Another interesting feature that emerges from the table is that, there is a consistent increase in the percentage of the arrears in relation to collection except during 1975-76. The percentage of arrears to collection in 1972-73 was 73.77 and it rose upto 93.03 in 1977-78. The decrease in arrears during 1975-76 might be on account of fear psychosis prevailing during the emergency.

Not only there has been an increase in the arrears, the total collection does not even meet the cost of collection. It is mainly because of the complicated procedure involved and existence of separate machinaries for the assessment and

collection of water rates that the cost of collection of water rates in relation to revenue realised is very high. It may be seen from Table 7, that the cost of collection has risen steadily in relation to revenue realised. So much, so that in 1977-78, the cost of collection is more than double the collection made. During the years ending 1977-78, the total revenue realised was Rs.21.89 million, while the total cost of collection was Rs.27.82 million, which was about 6 million rupees more than the amount collected.

To improve this state of affairs there are three specific suggestions with regard to simplification of assessment and collection procedure and reduction in the cost of collection. Wrong assessment is said to be the main reason behind the low collection and piling up of arrears. Once an objection petition against the assessment is filed by a farmer, the total money which is due to him is blocked for a long period. Even for the smallest rectification, the same long procedure is adopted as that for assessment. Not only the smallest rectification is not possible without due process, but partial collection is also not permitted. For example, in a case where there is a petition by a farmer for remission of 0.5 acre (Rs.16.25) against a receipt for Rs.656, the whole amount remains blocked till his petition is settled. Therefore, what we would suggest that partial collection (which is not disputed by the farmer) should be allowed.

To reduce the cost of water rates collection, we would suggest that collection work should be entrusted to the Revenue Department (as in U.P., Haryana, Punjab and West Bengal) and only the assessment work to be done by the Irrigation Department. There is no justification in having a separate machinery for the collection of water rates when a well developed and much more elaborate machinery for the collection of land revenue already exists.

The receipt which are prepared in the revenue division, Purnea, show dues against a cultivator for a single season. There is no method by which those engaged in the collection work can ascertain total dues, including arrears, against a cultivation. Therefore, what we would suggest that these receipts should be consolidated showing the total demand including the arrears against the various cultivators.

Work Charge Staff

One of the most neglected spheres of the Kosi irrigation management is the problem of work charge staff.²⁰ They consist of various categories of workers, from unskilled gang labour to highly skilled artisans and mechanics. There are even a few supervisory posts of special foreman belonging to this category. In all, there are about 4,500 work-charge staff in Kosi project. The problem of work-charge staff has arisen on account of lack of foresight and indiscriminate appointments in the initial stages of the project. The problem has, however, got aggravated on account of non-uti-

lization of their services in jobs where they can do well. There are instances which show that the proper utilization of workers has safeguarded the twin objectives of quality control and economy. The practice of giving work to contractors instead of making use of the services of these men is mainly on account of prevalence of corrupt practices. The apathy and lack of concern on the part of high ups in the secretariate seem to be responsible for their non-utilization in the new projects which have been under-taken by the State government in recent years. Therefore, in the present circumstances, when the State has limited resources and the technically competent manpower is available, they should be given the jobs which they can do in the Kosi project itself and in the case of surplus staff, they should be transferred to various ongoing new irrigation projects of the State Government.

Conclusion

The major concern of the public policy dealing with irrigation systems in recent years has been the productivity and equity. The question of productivity is closely related to the question of utilization of available water and the question of equity is related to the distributive benefits of irrigation to the various segments of the society. Judging from the point of view of productivity and equity, Kosi irrigation system falls far short in both these respects. Total emphasis on removal of technical deficiencies for

improved water utilization is not sufficient but adequate attention is also required to be given to improve the man-made deficiencies. Within the bureaucratic organization, these man-made deficiencies refer to the operative procedures of the bureaucracy. There is a feeling that substantial improvement in water utilization can be brought about by improving water management practices.

The solution to the equity problem, however, lies in the political commitment and supportive changes in the administrative practices and organization. Without the political will, all policies directed towards equity in Bihar would meet the fate of land reform measures, including the "Kosi Kranti Scheme". The support from bureaucracy for egalitarian policies would not be forthcoming unless there is a built in mechanism of gains for bureaucracy in discriminating against rich in favour of poor farmers. However, with genuine commitment of the political leadership, the tendencies towards increasing inequalities of irrigation benefits can be off set to a considerable extent by a variety of measures designed to improve the bureaucracy's management procedures and closer connections between performance and rewards and penalties.

Notes and References

1. The Kosi Irrigation Committee (1975) appointed by the Government of Bihar, came to the conclusion that the GCA was only 1.84 million acres (with a CCA of 1.08 million acres). This reduction in the GCA was caused because the Committee had deducted the spill areas of Ganga and Kosi, the area occupied by bigger towns and the area occupied by the abandoned courses of the river.
2. IAAP was a replica of the earlier IADP (Intensive Agricultural District Programme) which was formulated after recommendations to the Government by a Ford Foundation team which visited India in 1959.
3. Richard B. Reidnger : "Canal Irrigation and Institutions in India : Micro Study and Evaluation", Ph.D. Thesis, Duke University, 1971.
4. M.P. Pandey : The Impact of Irrigation on Rural Development : A Case Study, Concept Publishing Company, New Delhi, 1979.
5. Edward J. Clay : Technical Innovations and Public Policy : Agricultural Development in the Kosi Region, Bihar, India, IDS (mimeo), August 1980.
6. R.P. Singh : Agricultural Transformations in Kosi Region, North Bihar, India, Department of City and Regional Planning, Harvard University, Cambridge, Mass. (mimeo), 1978.
7. Bihar Through Figures 1977, Directorate of Statistics and Evaluation, Bihar, p.16.
8. "Problems of Small Farmers of Kosi Area (Purnea and Saharsa Districts) 1969", Government of Bihar Publication.
9. Wolf Ladejinsky : The Green Revolution in Bihar - The Kosi Area : A Field Trip, ADC, Reprint No.28, June 1976, p.8.
10. Ibid., p.9.
11. B.G. Verghese : "Kosi-Kranti : Land Reforms in Bihar", The Statesman (Calcutta), September 8 and 9, 1977.
12. D.D. Guru : Small Farmers Development Agency, Purnea - An Evaluation, A.N. Sinha Institute of Social Studies, Patna, June 1979 (mimeo).
13. G.B. Rodgers : The Conceptualization of Poverty in Kosi Area in the Kosi Symposium, edited by J.L. Joy and Elizabeth Everitt, IDS 1976, p.37.

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14. Geof Wood : The Process of Differentiation Among the Peasantry in Desipur Village in the Kosi Symposium, edited by J.L. Joy and Elizabeth Everitt, IDS 1976, p.125.
15. In the project report, the annual irrigation capacity from the Kosi Canal was placed at 1.83 million acres on the basis of a discharge of 15,000 cusecs, an intensity of irrigated cultivation at 115 per cent, and a CCA of 1.58 million acres. However, the Kosi Technical Committee (1975) placed the annual irrigation capacity at 0.92 million acres based on the intensity of irrigated cultivation at 85 per cent of the CCA of 1.08 million acres estimated by it.
16. Evaluation of the Kosi Embankment - A Case Study, Programme Evaluation Organization, Planning Commission, Government of India, 1979, p.iii.
17. For details see : (i) Report of the Kosi Technical Committee, Government of Bihar, 1965; (ii) The Report of the Kosi Technical Committee, Government of Bihar, 1971; and (iii) The Kosi Irrigation Committee, Government of Bihar, 1975.
18. However, it was reported in the Patna daily, 'The Search Light' (June 23, 1978) that Kosi Water was released for irrigation from May 20 that year to raise the production as well as the productivity of paddy.
19. See, the circular from the Secretary, Agriculture and Rural Development, Government of India, D.O. No.3-6/78 CAD, May 31, 1978.
20. Work-charge staff are those, whose salary is drawn from the work's head and not from the establishment. They are entitled to the benefits of provident fund. But their provident fund authority is the Executive Engineer of the respective division and not the Accountant General, Bihar. Though they get scales (introduced from October 1, 1960) as well as dearness allowance, but one major difference between them and the regular staff is that while the latter are entitled to pension benefits, the former are not.

Table 1

Percentage of Irrigated Area by Different Sources in Kosi Region

Size (in hectares)	Sources						Overall
	Canal	Tank	Well	Tubewell	Others		
Less than 2	23.41	41.11	29.11	20.09	28.41	23.69	
2 to 5	28.11	29.23	24.53	30.96	34.20	28.83	
5 to 20	30.65	22.95	28.30	34.98	28.87	30.81	
More than 20	17.83	6.71	18.06	13.97	8.52	16.67	
Total	100.00	100.00	100.00	100.00	100.00	100.00	
N	120,967	985	1,219	12,859	12,304	148,334	

Table 2

Distribution of Holdings and Area in Kosi Region

Size (in hectares)	Percentage of Holding Numbers	Percentage of Area
Less than 2	76.49	27.04
2 to 5	16.50	28.65
5 to 20	6.30	31.07
More than 20	0.71	13.24
Total	100.00	100.00
N	849,091	1,491,664

Table 3
Crop-wise Details of the Area

	Maximum Discharge (cusecs)	Area Irrigated (in Million Acres)					Percentage of area irrigated to the an- ticipated potential
		Kharif	Rabi	Hot Wea- ther	Total		
1964-65	2,000	0.009	.001	c.c.	.010	0.5	
1965-66	2,000	0.061	.002	.001	.064	3.5	
1966-67	6,000	0.153	.015	.011	.179	9.8	
1967-68	9,000	0.271	.027	.030	.328	17.9	
1968-69	9,500	0.254	.041	.033	.324	17.7	
1969-70	10,300	0.284	.034	c.c.	.318	17.4	
1970-71	10,700	0.188	.044	c.c.	.232	12.7	
1971-72	9,500	0.149	.057	.009	.215	11.7	
1972-73	14,543	0.349	.065	.050	.464	25.3	
1973-74	9,380	0.223	.046	c.c.	.269	14.6	
1974-75	10,000	0.218	.084	c.c.	.302	16.4	
1975-76	10,000	0.341	.074	c.c.	.417	22.7	
Average for the 5 years (1971-72 to 1975-76)		0.256	.066	.012	.334	18.2	
Area planned to be irriga- ted (in the project report)		1.03	.348	.462	1.84		

c.c. = canal closed

Table 4

Intensity of Cropping
(Area in Million Acres)

Year	Net Area Sown			Gross Cropped Area		
	Saharsa	Purnea	Total	Saharsa	Purnea	Total
1963-64	.627	1.680	2.307	.955	2.288	3.243
1964-65	.602	1.628	2.230	.924	2.084	3.068
1965-66	.721	1.598	2.319	.970	2.015	2.985
1966-67	.670	1.638	2.308	.968	2.070	3.038
1967-68	.766	1.670	2.436	1.224	2.185	3.409
1968-69	.779	1.712	2.491	1.167	2.241	3.408
1969-70	.867	1.739	2.606	1.197	2.390	3.587
1970-71	.868	1.746	2.614	1.238	2.327	2.565
1971-72	.817	1.660	2.477	1.115	2.301	3.416
1972-73	.814	1.694	2.508	1.130	2.211	3.341
1973-74	.814	1.675	2.489	1.091	2.178	3.269

Note : Purnea includes Katihar

Table 5

Productivity of Crops (Quintals per Acre)

Year	Kharif Paddy	Wheat
1963-64	3.40	1.72
1964-65	2.91	2.02
1965-66	2.61	2.73
1966-67	1.31	2.24
1967-68	2.02	3.29
1968-69	2.24	3.50
1969-70	1.90	2.31
1970-71	2.31	3.99
1971-72	1.19	5.42
1972-73	3.39	4.11
1973-74	2.91	6.09

Table 6

Demand, Collection and Balance of Water Rates

(Rs. in millions)

Year	Arrears at the beginning of the financial year	Current demand	Total demand	Actual collection	Remissions by way of rectification of demands	Arrears at the end of the year	% of arrear to collection of demands during the year
1972-73	6.471	2.572	9.043	2.369	0.003	6.671	73.7
1973-74	6.671	9.265	15.936	3.084	0.005	12.847	80.6
1974-75	12.846	7.601	20.447	3.708	0.006	16.733	81.8
1975-76	16.733	9.947	26.680	6.059	0.004	20.613	77.2
1976-77	20.617	15.976	36.093	3.997	0.007	32.089	88.9
1977-78 (upto February)	32.089	6.283	38.372	2.676	-	35.696	93.0

Table 7

Establishment Cost and Collection of Water Rates

(Rs. in millions)

Year	Establishment cost (assessment side)	Establishment cost (collection side)	Total cost	Total collection
1972-73	2.722	1.162	3.889	2.369
1973-74	2.811	1.202	4.013	3.084
1974-75	2.933	1.300	4.233	3.708
1975-76	3.170	1.624	4.794	6.059
1976-77	3.200	1.800	5.000	3.997
1977-78 (upto February)	3.529	2.363	5.897	2.676
Total	18.365	9.456	27.821	21.893